# CAPT Science Performance Task

## Soapy Water

Local water treatment plants often remove environmentally harmful impurities, such as soap, from waste water before returning it to the environment.

One way to remove soap from water is to have it react with other substances. When these reactions occur, a solid called a *precipitate* is sometimes formed. The precipitate can be filtered out of the water.

**Your Task**

You will design and conduct an experiment to explore the use of several substances in removing soap from water. During this activity you will work with a lab partner (or possibly two partners). You must keep your own individual lab notes because after you finish, you will work independently to write a lab report about your experiment.

You have been provided with the materials and equipment listed below. It may not be necessary to use all of the equipment that has been provided. You may use additional materials or equipment if they are available.

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**Powdered soap**
**Table salt**
**Epsom salt**
**Sugar**
**4 paper cups**
**8 clear plastic cups**
**4 white plastic spoons/stirring rods**
**Graduated cylinder**
**Access to tap water**
**Access to a balance**
**Access to a clock or watch with a second hand**
**Paper towels for cleanup**
**Splash-proof goggles and apron for each student**
**4 test tubes**
**Test tube rack**
**Test tube brush**
**Parafilm(to cover test tubes)**
**Marking pencil**
**5 paper cones**
**5 pieces of filter paper**
**Ruler**
**Scissors**
**1 beaker**
**Labeling dots**

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## Steps to Follow

1. **In your own words, clearly state the problem you are going to investigate.** Include a clear identification of the independent and dependent variables that will be studied. Write your statement of the problem on the page provided.

2. **Preparing Soapy Water:** Mix 300 mL of water with one level spoonful (using a *blue* plastic spoon) of powdered soap in a beaker. This will serve as your supply of soapy water for the experiment.

   **Making a Funnel:** To make a funnel, cut off the tip of a paper cone approximately 2 centimeters from the bottom. To filter, place the filter paper into the cone.

   **Testing for the Presence of Soap:** To test for the presence of soap in water after precipitation and filtration, place the solution in a test tube. Wrap the top of the test tube with a piece of parafilm, place your thumb over the top of the tube and **shake carefully**. The amount of suds that form is an approximate indication of the amount of soap left in the water.

3. **Design an experiment to solve the problem.** Your experimental design should match your statement of the problem, should control variables, and should be clearly described so that someone else could easily replicate your experiment. Include a control if appropriate.

   Write your experimental design on the page provided. Show your design to your teacher before you begin your experiment.

4. **After receiving approval from your teacher, work with your partner to carry out your experiment.** Your teacher's approval does not necessarily mean that your teacher thinks your experiment is well designed. It simply means that in your teacher's judgment your experiment is not dangerous or likely to cause an unnecessary mess.

5. **While conducting your experiment, take notes on the attached pages.** Include the results of your experiment. Tables, charts and/or graphs, should be used where appropriate and should be properly labeled.

   Your notes will **not** be scored, but they will be helpful to you later as you work independently to write about your experiment and results. You **must** keep your own notes because you will not work with your partner when you write your lab report.

   **When you have finished your experiment, your teacher will give you instructions for cleanup procedures, including proper disposal of all materials .**

   *(Students are provided with four blank pages for their notes, as well as a grid for tables, charts or graphs.)*

# Directions for Writing Your Laboratory Report

Working on your own, summarize your experiment and results. You may use your own notes that you took previously while working with your partner. You may wish to write a first draft of your lab report on scratch paper. Space for your final report is provided. You will have approximately 30 minutes to complete your report.

Your report should include the following:

- **A clear statement of the problem you investigated.** Include a clear identification of the independent and dependent variables that were studied.

- **A description of the experiment you carried out.** Your description should be clear and complete enough so that someone else could easily replicate your experiment.

- **The results of your experiment**. Tables, charts and/or graphs should be used where appropriate and should be properly labeled. Space for your data is provided.

- **Your conclusions from the experiment.** Your conclusions should be fully supported by data.

- **Comments about how valid you think your conclusions are.** In other words, how much confidence do you have in your results and conclusions? Any factors that contribute to a lack of confidence in the results or conclusions should be discussed. Also, include ways that your experiment could be improved if you were to do it again.

*(Students are provided with four lined pages for their reports, as well as a grid for tables, charts or graphs. )*

# CAPT Experimentation Questions

## Soapy Water

Students in a science class were conducting experiments to explore the use of various substances in removing soap from water. One way to remove soap from water is to have it react with other substances. When the reactions occur, a solid called a precipitate is sometimes formed. A precipitate can be filtered out of the water.

**Group A** carried out the following experiment.

1. We put soapy water into three separate plastic cups.
2. A different substance was added to each of the cups.
3. After waiting five minutes, the mixture in each cup was filtered.
4. We examined the precipitate (which remained in the filter paper) and the filtrate (which was in the test tube) for each mixture.

The table below shows our results.

| | 1 | 2 | 3 |
|---|---|---|---|
| **Substance added to Soapy Water** | Epsom Salt | Table Salt | Sugar |
| **Precipitate** | White, milky | White, milky | None |
| **Filtrate** | Clear | Slightly cloudy | Cloudy |

**1.** Based on their results, Group A concluded that Epsom salt removed the soap from the water. Is this a valid conclusion? Explain your answer fully.

**2.** Do you have enough information to replicate Group A's experiment? If you think so, explain what information you have. If you think not, explain what other information you would need.

**Group B** carried out the following experiment.

1. We placed 50 mL of soapy water into three plastic cups.
2. We added 10 grams of sugar to cup 1, 10 grams of table salt to cup 2, and 10 grams of Epsom salt to cup 3. We mixed each with a plastic spoon.
3. We filtered all three mixtures.
4. We then poured the filtrate (remaining liquid) into 3 separate test tubes, shook them and measured the height of the soap suds.

The table below shows our results.

| Cup | Substance | Final Soap Suds Height |
|---|---|---|
| **1** | Sugar | 9.1 cm |
| **2** | Table Salt | 1.2 cm |
| **3** | Epsom Salt | 0.2 cm |

**3.** Group B did not include a control in their experiment. What would be an appropriate control? Explain your answer fully, including how the control might improve the experiment.

**4.** Compare Group A's and Group B's experiments. Which experiment, if either, is better designed? Explain your answer fully .